Cocoa Tips and Tricks

Session 116

These are confidential sessions—please refrain from streaming, blogging, or taking pictures.

Cocoa Tips and Tricks

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Who's There?

Just starting out	
Some Cocoa experience	
Cocoa expert	

Topics

- Zombies
- Debugging
- Overlay views
- Key-value observing and concurrency

Zombies

Pop Quiz:
What do the following have in common?

Crash in objc_msgSend

```
#0   0x7fff8320e4cc in objc_msgSend
#1   0x100000f2d in -[ZombieAppDelegate crashA:] at ZombieAppDelegate.m:81
...
```

Crash in Notification Send

```
#0     0x7fff8320e4d0 in objc_msgSend
#1     0x7fff82b98615 in _nsnote_callback
#2     0x7fff8898742a in __CFXNotificationPost
#3     0x7fff88986de8 in _CFXNotificationPostNotification
...
```

Crash in Autorelease Pool Pop

```
#0    0x7fff8320e4cc in objc_msgSend
#1    0x7fff88a48056 in _CFAutoreleasePoolPop
#2    0x7fff82b80f33 in -[NSAutoreleasePool drain]
#3    0x7fff81d3f722 in -[NSApplication run]
#4    0x7fff81d2df6a in NSApplicationMain
...
```

Crash in Delegate Call

```
#0    0x7fff8320f588 in objc_msgSend_vtable5
#1    0x7fff81f8345f in -[NSTextField textShouldBeginEditing:]
#2    0x7fff81e3f151 in -[NSTextView(NSSharing)
                          shouldChangeTextInRanges:replacementStrings:]
#3    0x7fff81f8268a in -[NSTextView insertText:replacementRange:]
#4    0x7fff81f7c9e9 in -[NSTextInputContext handleTSMEvent:]
...
```

Disappointed Users

Answer

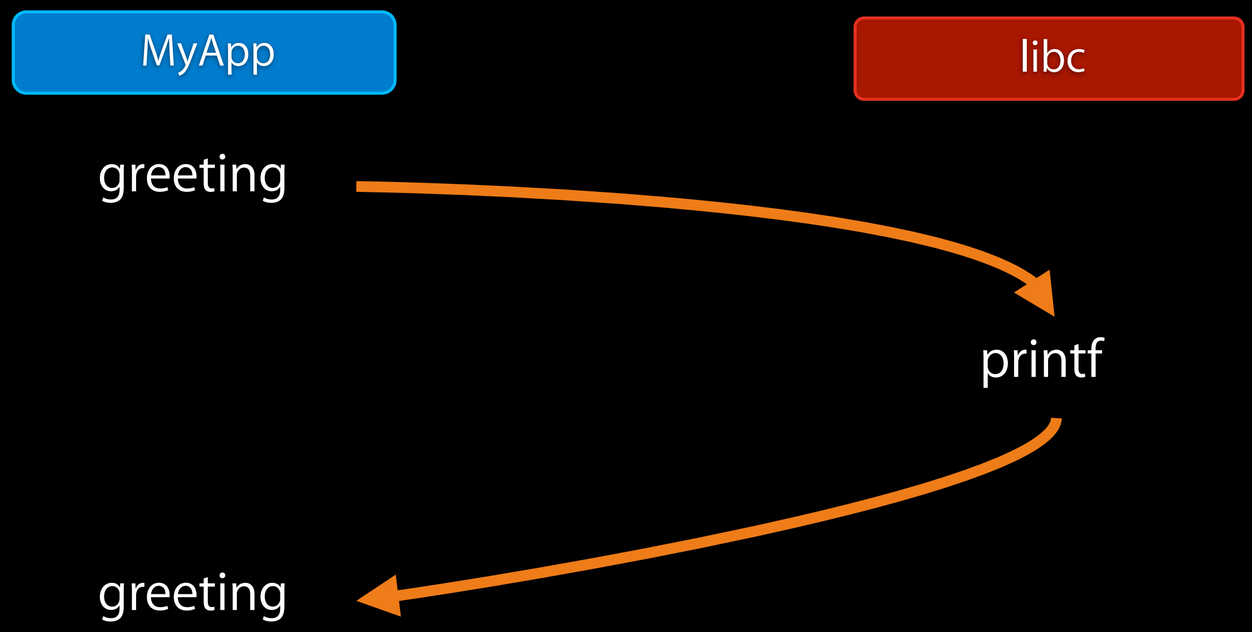
objc_msgS d is buggy!

Answer

- Result of accessing over-released memory
- But only the first one was in my code!

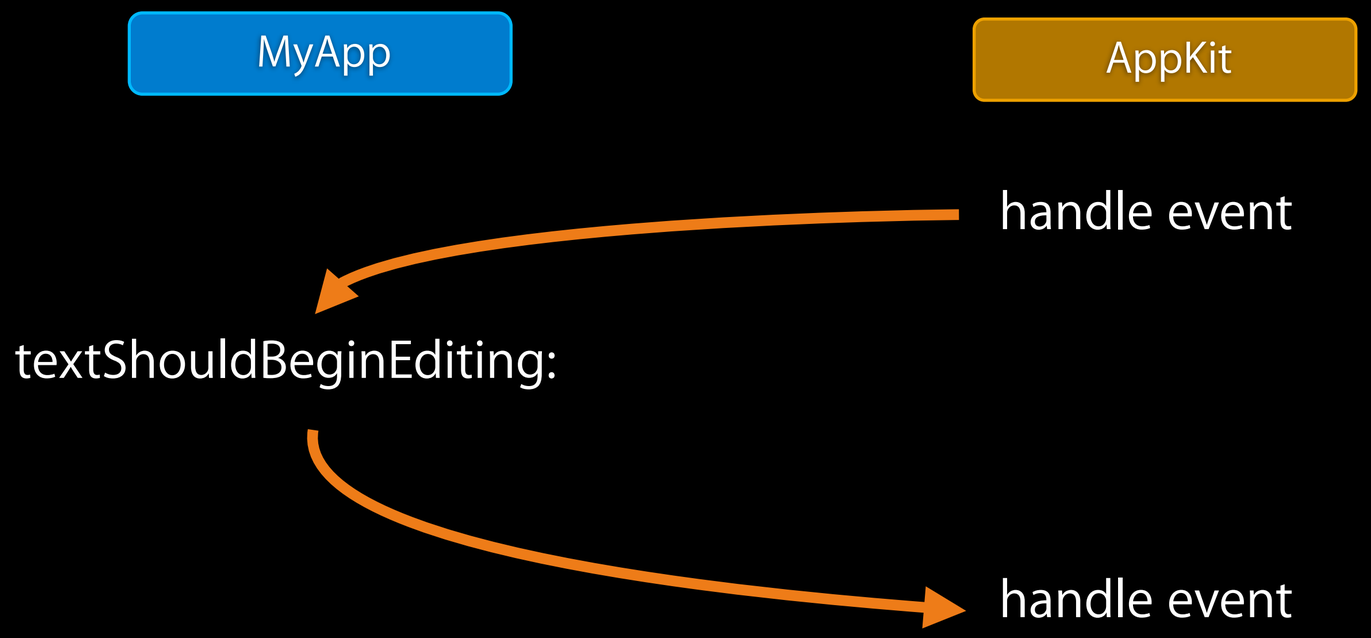
Libraries and Frameworks

```
void greeting() {
    printf("hello world\n");
}
```



Libraries and Frameworks

```
- (BOOL)textShouldBeginEditing:(NSText *)textObject {
    return timeIsRight;
}
```



“Don’t call us. We’ll call you.”

A Hollywood Agent

delegation, target-action, view drawing, responder chain and event handling, enumeration, archiving, notifications, key-value observing, documents, bindings, distributed objects, operations, run loops, undo, xml parsing, menu and toolbar validation, services, pasteboard, drag and drop, table and outline view data source, etc…

Zombies

What's a zombie?

- Class which stops execution of your program when a message is sent to a deallocated object
- Enabled by setting NSZombieEnabled environment variable to YES

How Do Zombies Work?

```
MyObj *obj = [[MyObj alloc] init];
```

1

```
[obj retain];
```

2

```
[obj release];
```

1

```
[obj release];
```

```
[obj dealloc];
```

x

Zombify

```
[obj doStuff];
```

Demo

Zombies

Summary

- Zombies help detect problems early
- Enable with NSZombieEnabled set to YES
- Use from Xcode or new Zombies instrument
- Note: Not used in garbage-collected applications

Fun Fact

- Bugs happen
- …even in Apple frameworks
- File a report at bugreport.apple.com
- Include:
  - System configuration
  - Regression info
  - Steps to reproduce
  - Test case
- Thank you!

Debugging

What You Already Know About gdb

- Controlling execution

- ‘print-object’ or ‘po’
  - Calls -debugDescription method on an object
    - …which calls -description
  - Implement -description on your own objects

gdb Tips

- Call other methods and functions
- Change state
- Execute alternate branches
- Run debugger commands automatically or conditionally

“Sometimes when I move shapes around in Sketch, they don’t draw right. Help! I have a school assignment due tomorrow!”

SketchKid2002

Demo

Debugging with gdb

“hay, wen i triz ta maeks ma lolcat picz in sketch, teh kitteh iz upsied down”

lolzmaekr

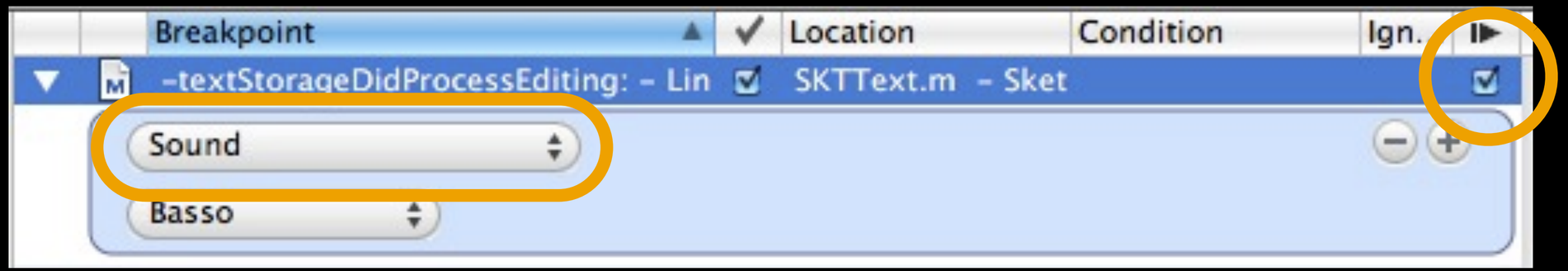
Demo

More debugging with gdb

Enable Breakpoints at Breakpoints

```
(gdb) br someEarlyFunc
Breakpoint 1 at ...
(gdb) br someLaterFunc
Breakpoint 2 at ...
(gdb) disable 2
(gdb) commands 1
>enable 2
>continue
>end
(gdb) commands 2
>disable 2
>end
(gdb)
```

Sound at a Breakpoint



Archive Object Graph

```
(gdb) call (BOOL)[NSKeyedArchiver archiveRootObject:foo
 toFile:@"/tmp/myfile.format"]

(gdb) set var foo=(id)[NSKeyedUnarchiver
 unarchiveObjectWithFile:@"/tmp/myfile.format"]
```

Caution

- gdb cannot stop all other threads when executing
- Methods which reenter might cause problems
- Watch out for deadlock
- Understand your application

Summary

- Call other methods and functions
- Change state
- Execute alternate branches
- Run debugger commands automatically or conditionally

dtrace Tips

- Low-level system debugging and profiling utility
- Can be used to investigate higher-level applications
- Via
  - Instruments
  - dtrace utility

Measuring Sketch Archiving Time

```
#!/usr/bin/env dtrace -qs
```

Measuring Sketch Archiving Time

```
#!/usr/bin/env dtrace -qs

objc$1:
{

}
```

Measuring Sketch Archiving Time

```
#!/usr/bin/env dtrace -qs

objc$1:SKTDocument:
{

}
```

Measuring Sketch Archiving Time

```
#!/usr/bin/env dtrace -qs

objc$1:SKTDocument:-dataOfType?error?:
{

}
```

Measuring Sketch Archiving Time

```
#!/usr/bin/env dtrace -qs

objc$1:SKTDocument:-dataOfType?error?:entry
{

}
```

Measuring Sketch Archiving Time

```
#!/usr/bin/env dtrace -qs

objc$1:SKTDocument:-dataOfType?error?:entry
{
    self->enterTime = vtimestamp;
}
```

Measuring Sketch Archiving Time

```
#!/usr/bin/env dtrace -qs

objc$1:SKTDocument:-dataOfType?error?:entry
{
    self->enterTime = vtimestamp;
}

objc$1:SKTDocument:-dataOfType?error?:return
{


}
```

Measuring Sketch Archiving Time

```
#!/usr/bin/env dtrace -qs

objc$1:SKTDocument:-dataOfType?error?:entry
{
    self->enterTime = vtimestamp;
}

objc$1:SKTDocument:-dataOfType?error?:return
{
    this->totalTime = vtimestamp - self->enterTime;

}
```

Measuring Sketch Archiving Time

```
#!/usr/bin/env dtrace -qs

objc$1:SKTDocument:-dataOfType?error?:entry
{
    self->enterTime = vtimestamp;
}

objc$1:SKTDocument:-dataOfType?error?:return
{
    this->totalTime = vtimestamp - self->enterTime;
    printf("%d\n", this->totalTime);
}
```

Demo

Measuring with dtrace

Stop Your App

```
#!/usr/bin/env dtrace -wqs

Cocoa_Autorelease$1:*:*:error_no_pool
{
    stop();
}
```

```
sudo ./nopool.d 4739

gdb attach 4739

Program received signal SIGSTOP, Stopped (signal).
0x00007fff88a483d5 in __NSAutoreleaseNoPool ()
(gdb)
```

Log Method Entry

```
objc$1:SKTDocument:*:entry
{
    printf("Entered: %s\n", probefunc);
}
```

```
Entered: -graphics
Entered: -observeUndoManagerCheckpoint:
Entered: -insertGraphics:atIndexes:
Entered: -startObservingGraphics:
Entered: -graphics
Entered: -graphics
Entered: -graphics
...
```

Debug Deadlock

```
objc$1:NSLock:-lock:entry
{


}

objc$1:NSLock:-lock:return
{


}
```

Debug Deadlock

```
objc$1:NSLock:-lock:entry
{
    self->lockObj = arg0;

}

objc$1:NSLock:-lock:return
{

    printf("%d locked %x\n", tid, self->lockObj);
}
```

Debug Deadlock

```
unsigned long lockOwner[unsigned long];

objc$1:NSLock:-lock:entry
{
    self->lockObj = arg0;

}

objc$1:NSLock:-lock:return
{
    lockOwner[self->lockObj] = tid;
    printf("%d locked %x\n", tid, self->lockObj);
}
```

Debug Deadlock

```
unsigned long lockOwner[unsigned long];

objc$1:NSLock:-lock:entry
{
    self->lockObj = arg0;
    printf("%d attempting to lock %x, owned by %d\n",
        tid, arg0, lockOwner[self->lockObj]);
}

objc$1:NSLock:-lock:return
{
    lockOwner[self->lockObj] = tid;
    printf("%d locked %x\n", tid, self->lockObj);
}
```

Debug Deadlock

```
objc$1:NSLock:-unlock:entry
{

}

objc$1:NSLock:-unlock:return
{

}
```

Debug Deadlock

```
objc$1:NSLock:-unlock:entry
{
    self->unlockObj = arg0;
}

objc$1:NSLock:-unlock:return
{
    lockOwner[self->unlockObj] = 0;
}
```

Debug Deadlock

```
objc$1:NSLock:-unlock:entry
{
    self->unlockObj = arg0;
}

objc$1:NSLock:-unlock:return
{
    lockOwner[self->unlockObj] = 0;
    printf("%d unlocked %x\n", tid, self->unlockObj);
}
```

Debug Deadlock

```
1 attempting to lock A, owned by 0
1 locked A
1 attempting to lock B, owned by 0
2 attempting to lock B, owned by 0
2 locked B
2 attempting to lock A, owned by 1
```

Debug Deadlock

```
1 attempting to lock A, owned by 0
1 locked A
1 attempting to lock B, owned by 0
2 attempting to lock B, owned by 0
2 locked B
2 attempting to lock A, owned by 1
```

Debug Deadlock

```
1 attempting to lock A, owned by 0
1 locked A
1 attempting to lock B, owned by 0
2 attempting to lock B, owned by 0
2 locked B
2 attempting to lock A, owned by 1
```

Debug Deadlock

```
1 attempting to lock A, owned by 0
1 locked A
1 attempting to lock B, owned by 0
2 attempting to lock B, owned by 0
2 locked B
2 attempting to lock A, owned by 1
```

Debug Deadlock

```
1 attempting to lock A, owned by 0
1 locked A
1 attempting to lock B, owned by 0
2 attempting to lock B, owned by 0
2 locked B
2 attempting to lock A, owned by 1
```

Root cause: Taking two locks in opposite order

Summary

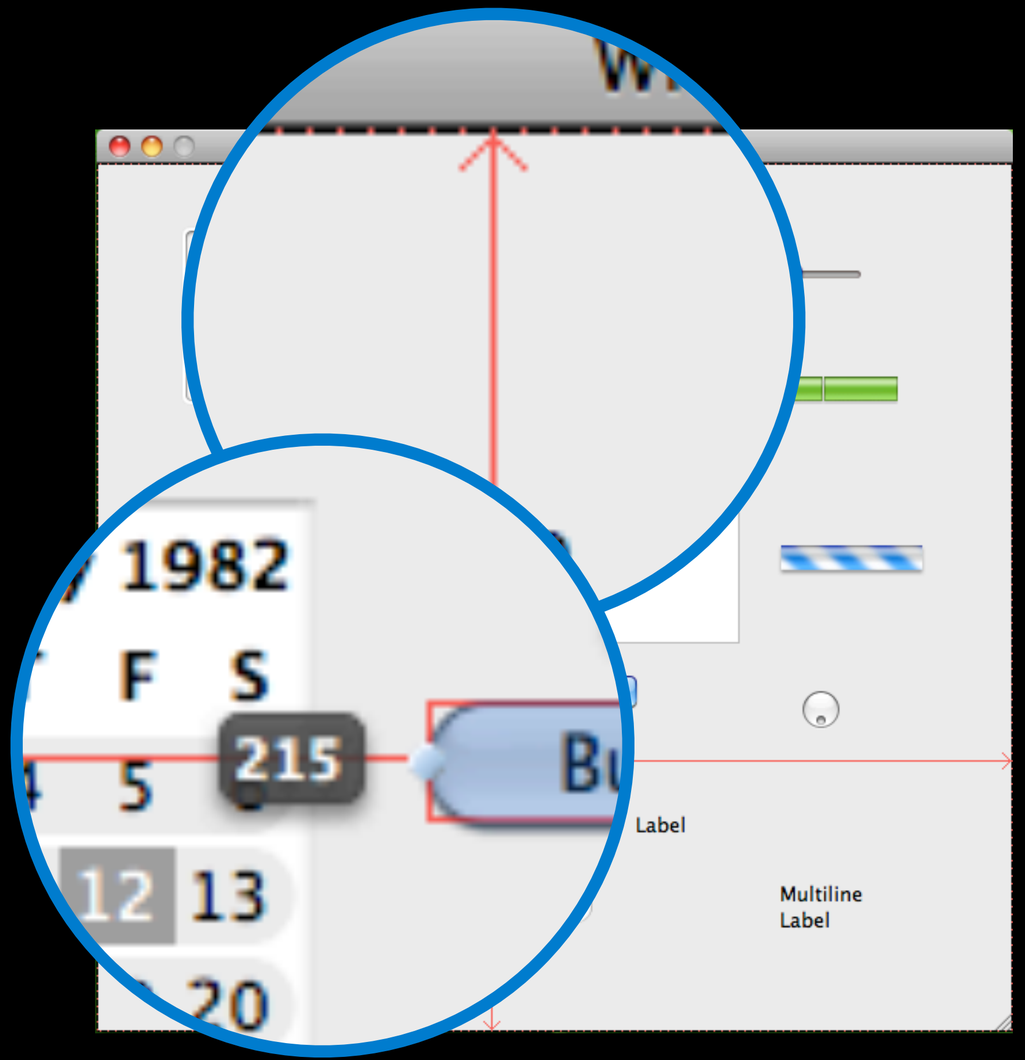
- Investigate code behavior and trends
- Answer questions about your application
- Add hooks almost anywhere in Cocoa with Obj-C provider

Fun Fact

- You can attach to a process that hasn’t launched yet with gdb

```
% gdb --waitfor TextEdit
Waiting for process 'TextEdit' to launch.
Attaching to process 3130.
(gdb)
```

Overlay Views


1982
F S
215
5
12 13
20
Label
Multiline
Label

Overlay Window

```
- (void)addChildWindow:(NSWindow *)childWin
               ordered:(NSWindowOrderingMode)place;
```

10.2

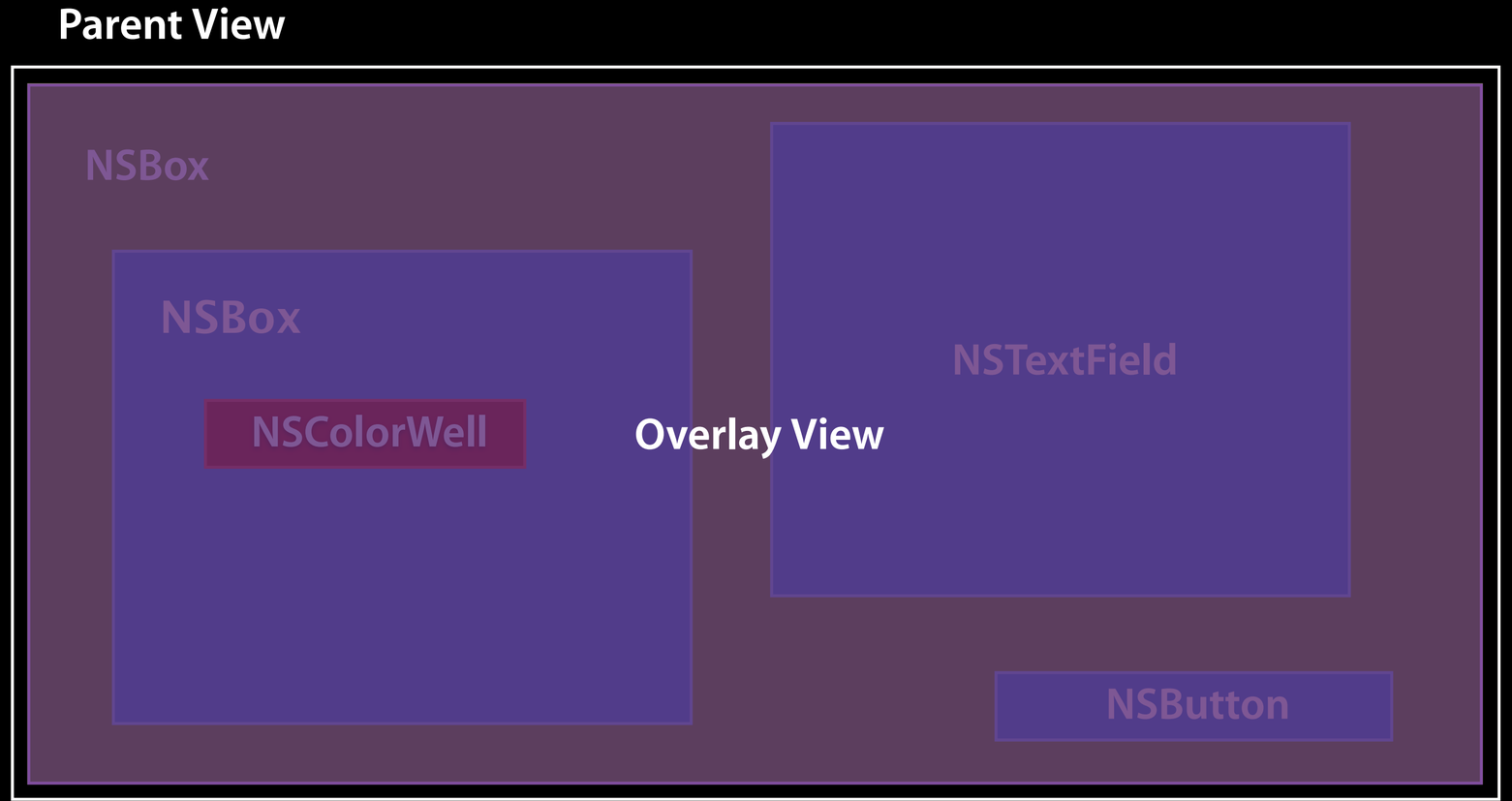
- Potentially more resource intensive
- Advantages
  - Can overlap NSOpenGLView or layer-backed views
  - Provide effect of drawing “outside” window

Presenting User Data with Table Views and Browsers	Nob Hill Thursday 10:30AM

Overlay View

- Sibling of other views
- Added as the last subview of parent
- Simple to implement, easy to understand

10.5


Parent View
NSBox
NSBox
NSColorWell
NSTextField
Overlay View
NSButton

Controller

```
- (void)awakeFromNib {




}
```

Controller

```
- (void)awakeFromNib {
    overlayView = [[OverlayView alloc] initWithFrame:
        [viewToOverlay frame]];
    [overlayView setAutoresizingMask:
        NSViewWidthSizable | NSViewHeightSizable];


}
```

Controller

```
- (void)awakeFromNib {
    overlayView = [[OverlayView alloc] initWithFrame:
        [viewToOverlay frame]];
    [overlayView setAutoresizingMask:
        NSViewWidthSizable | NSViewHeightSizable];

    [overlayView setHidden:!editing];
    [overlayView setOverlaidView:viewToOverlay];


}
```

Controller

```
- (void)awakeFromNib {
    overlayView = [[OverlayView alloc] initWithFrame:
        [viewToOverlay frame]];
    [overlayView setAutoresizingMask:
        NSViewWidthSizable | NSViewHeightSizable];

    [overlayView setHidden:!editing];
    [overlayView setOverlaidView:viewToOverlay];

    [[viewToOverlay superview] addSubview:overlayView];
}
```

Controller

```
- (void)setEditing:(BOOL)edit {




}
```

Controller

```
- (void)setEditing:(BOOL)edit {
    if (edit != [self editing]) {
        editing = edit;

    }
}
```

Controller

```
- (void)setEditing:(BOOL)edit {
    if (edit != [self editing]) {
        editing = edit;
        [overlayView setHidden:!editing];
    }
}
```

View

```
- (void)drawRect:(NSRect)rect;
```

View

```
- (void)drawRect:(NSRect)rect;

- (void)mouseMoved:(NSEvent *)theEvent;
- (void)mouseDown:(NSEvent *)theEvent;
- (void)mouseDragged:(NSEvent *)theEvent;
```

Demo

Overlay views

Summary

- Use to draw on top of overlapping sibling views
- Last subview of parent view
- Download “OverlayView” example

Fun Fact

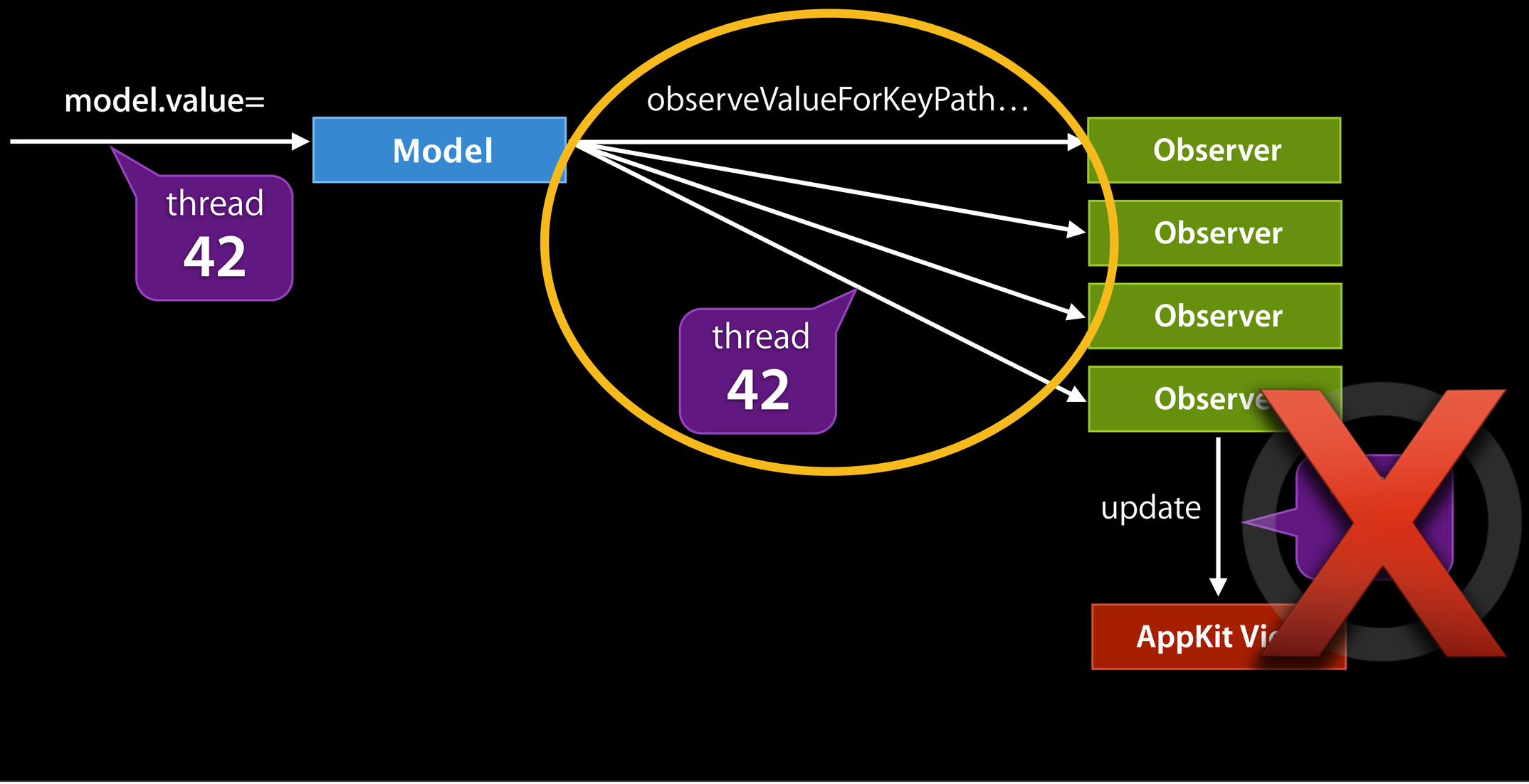
- When debugging, you can get a list of view information by calling a special description method

```
(gdb) po [aView _subtreeDescription]
[   A       ] h=--- v=--- NSView 0x3a55d0 f=(0,0,42,210) b=(-)…
[   AF      ] h=--& v=--& NSMatrix 0x3a5700 "1" f=(0,0,42,210)…

A=autoresizesSubviews, C=canDrawConcurrently, D=needsDisplay,
F=flipped, G=gstate, H=hidden (h=by ancestor), O=opaque,
P=preservesContentDuringLiveResize, S=scaled/rotated, W=wantsLayer
(w=ancestor wantsLayer), #=has surface
```

Key-Value Observing and Concurrency

KVO Overview

- Allows objects to be notified of changes to properties in other objects



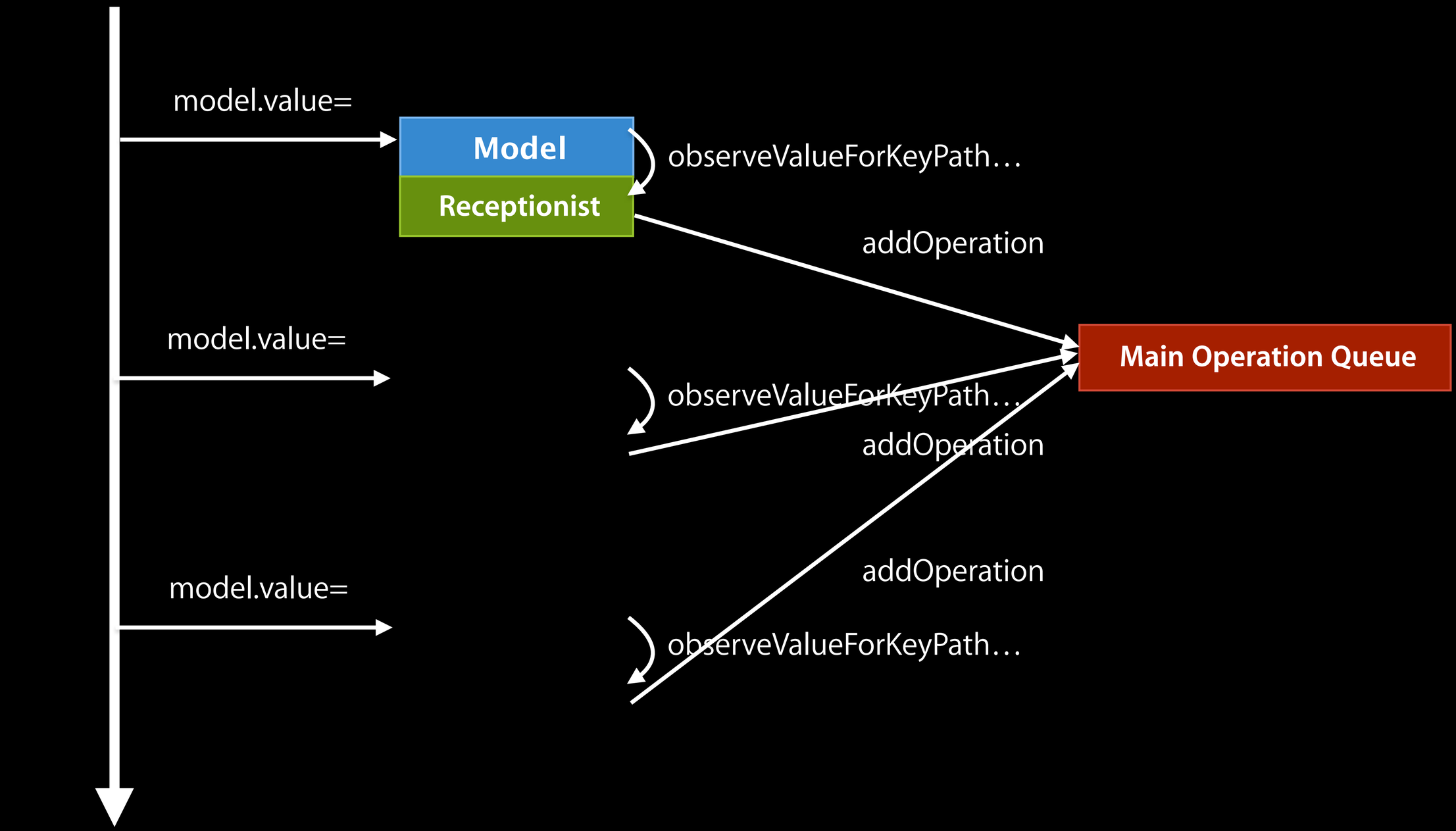
KVO Overview

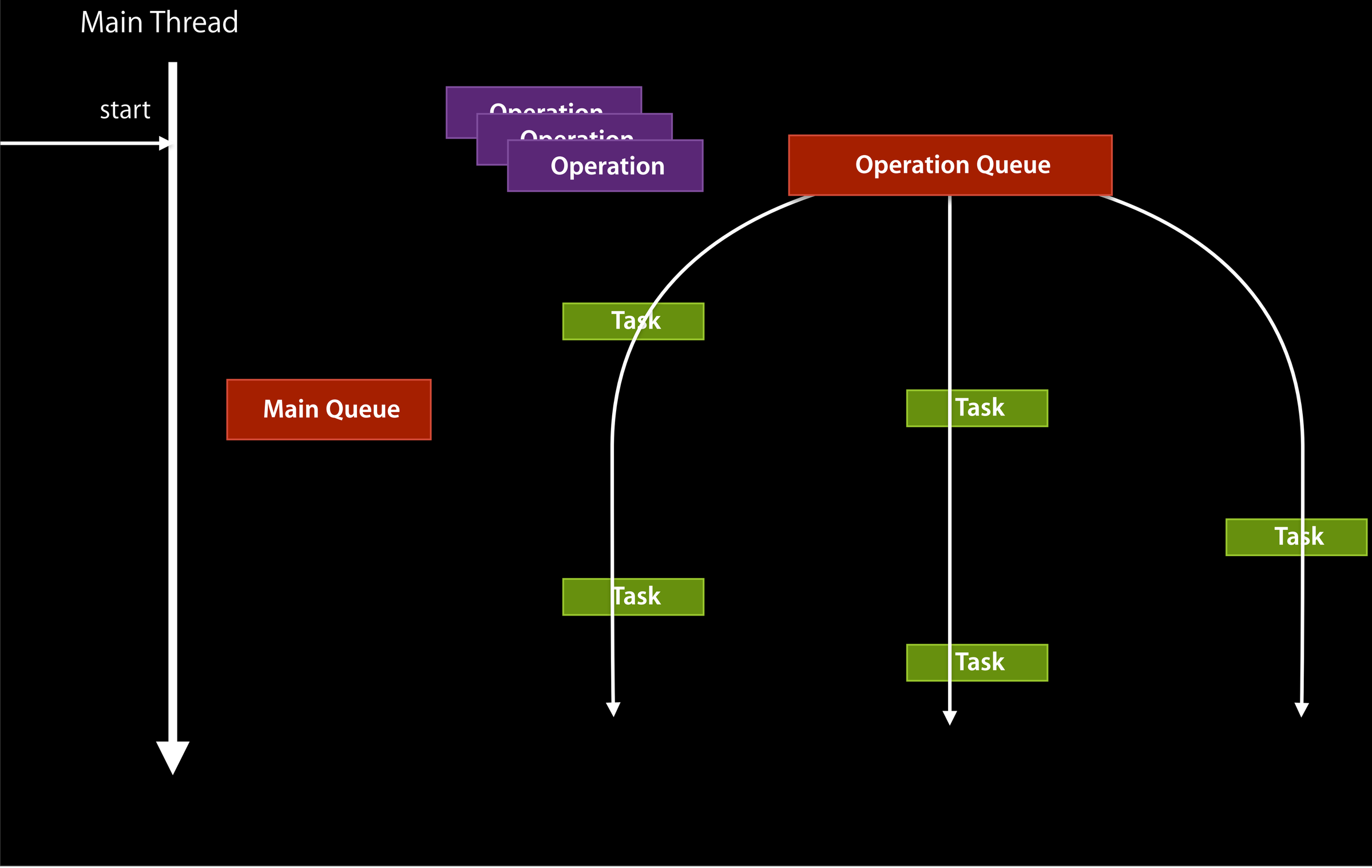
- How do I connect an update to a model object on a background thread to the user interface?

KVO Receptionist

- Thread middleman
- Receptionist will
  - Receive change notification
  - Execute task on another operation queue
- Use Snow Leopard block objects

10.6


Worker Thread
model.value=
Model
Receptionist
observeValueForKeyPath…
addOperation
Main Operation Queue
model.value=
observeValueForKeyPath…
addOperation
addOperation
model.value=
observeValueForKeyPath…


Main Thread
start
Operation
Operation
Operation
Operation Queue
Task
Main Queue
Task
Task
Task
Task

Receptionist

```
typedef void (^RCTaskBlock)(NSString *keyPath, id object,
NSDictionary *change);
```

Receptionist

```
typedef void (^RCTaskBlock)(NSString *keyPath, id object,
NSDictionary *change);

@interface RCReceptionist : NSObject {
    id observedObject;
    NSString *observedKeyPath;
    RCTaskBlock task;
    NSOperationQueue *queue;
}


@end
```

Receptionist

```
typedef void (^RCTaskBlock)(NSString *keyPath, id object,
NSDictionary *change);

@interface RCReceptionist : NSObject {
    id observedObject;
    NSString *observedKeyPath;
    RCTaskBlock task;
    NSOperationQueue *queue;
}
+ (id)receptionistForKeyPath:(NSString *)path object:(id)obj
queue:(NSOperationQueue *)queue task:(RCTaskBlock)task;
@end
```

Receptionist

```
+ (id)receptionistForKeyPath:(NSString *)path
                      object:(id)obj
                       queue:(NSOperationQueue *)queue
                        task:(RCTaskBlock)task {



}
```

Receptionist

```
+ (id)receptionistForKeyPath:(NSString *)path
                      object:(id)obj
                       queue:(NSOperationQueue *)queue
                        task:(RCTaskBlock)task {
    RCReceptionist *receptionist = [RCReceptionist new];


}
```

Receptionist

```
+ (id)receptionistForKeyPath:(NSString *)path
                      object:(id)obj
                       queue:(NSOperationQueue *)queue
                        task:(RCTaskBlock)task {
    RCReceptionist *receptionist = [RCReceptionist new];
    receptionist->task = [task copy];

}
```

Receptionist

```
+ (id)receptionistForKeyPath:(NSString *)path
                      object:(id)obj
                       queue:(NSOperationQueue *)queue
                        task:(RCTaskBlock)task {
    RCReceptionist *receptionist = [RCReceptionist new];
    receptionist->task = [task copy];
    receptionist->observedKeyPath = [path copy];
    receptionist->observedObject = [obj retain];
    receptionist->queue = [queue retain];



}
```

Receptionist

```
+ (id)receptionistForKeyPath:(NSString *)path
                      object:(id)obj
                       queue:(NSOperationQueue *)queue
                        task:(RCTaskBlock)task {
    RCReceptionist *receptionist = [RCReceptionist new];
    receptionist->task = [task copy];
    receptionist->observedKeyPath = [path copy];
    receptionist->observedObject = [obj retain];
    receptionist->queue = [queue retain];
    [obj addObserver:receptionist forKeyPath:path
        options:NSKeyValueObservingOptionNew |
        NSKeyValueObservingOptionOld context:0];

}
```

Receptionist

```
+ (id)receptionistForKeyPath:(NSString *)path
                      object:(id)obj
                       queue:(NSOperationQueue *)queue
                        task:(RCTaskBlock)task {
    RCReceptionist *receptionist = [RCReceptionist new];
    receptionist->task = [task copy];
    receptionist->observedKeyPath = [path copy];
    receptionist->observedObject = [obj retain];
    receptionist->queue = [queue retain];
    [obj addObserver:receptionist forKeyPath:path
        options:NSKeyValueObservingOptionNew |
        NSKeyValueObservingOptionOld context:0];
    return [receptionist autorelease];
}
```

Receptionist

```
- (void)observeValueForKeyPath:(NSString *)keyPath
                      ofObject:(id)object
                        change:(NSDictionary *)change
                       context:(void *)context {



}
```

Receptionist

```
- (void)observeValueForKeyPath:(NSString *)keyPath
                      ofObject:(id)object
                        change:(NSDictionary *)change
                       context:(void *)context {
    [queue addOperationWithBlock:^{

    }];
}
```

10.6

Receptionist

```
- (void)observeValueForKeyPath:(NSString *)keyPath
                      ofObject:(id)object
                        change:(NSDictionary *)change
                       context:(void *)context {
    [queue addOperationWithBlock:^{
        task(keyPath, object, change);
    }];
}
```

10.6

Controller

```
NSOperationQueue *mainQueue = [NSOperationQueue mainQueue];
```

10.6

Controller

```
NSOperationQueue *mainQueue = [NSOperationQueue mainQueue];
RCReceptionist *receptionist =
    [RCReceptionist receptionistForKeyPath:
                                    object:
                                     queue:
                                      task:

];
```

Controller

```
NSOperationQueue *mainQueue = [NSOperationQueue mainQueue];
RCReceptionist *receptionist =
    [RCReceptionist receptionistForKeyPath:@"value"
                                    object:model
                                     queue:mainQueue
                                      task:

];
```

Controller

```
NSOperationQueue *mainQueue = [NSOperationQueue mainQueue];
RCReceptionist *receptionist =
    [RCReceptionist receptionistForKeyPath:@"value"
                                    object:model
                                     queue:mainQueue
                                      task:
^(NSString *keyPath, id object, NSDictionary *change) {

}];
```

Controller

```
NSOperationQueue *mainQueue = [NSOperationQueue mainQueue];
RCReceptionist *receptionist =
    [RCReceptionist receptionistForKeyPath:@"value"
                                    object:model
                                     queue:mainQueue
                                      task:
^(NSString *keyPath, id object, NSDictionary *change) {
        // This will execute on the main queue
}];
```

Controller

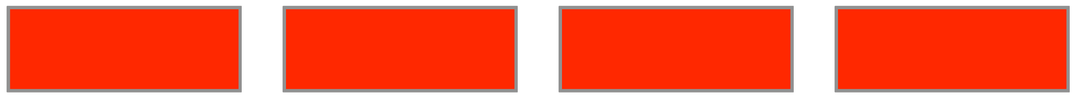
```
NSOperationQueue *mainQueue = [NSOperationQueue mainQueue];
RCReceptionist *receptionist =
    [RCReceptionist receptionistForKeyPath:@"value"
                                    object:model
                                     queue:mainQueue
                                      task:
     ^(NSString *keyPath, id object, NSDictionary *change) {
           // This will execute on the main queue
     }];


[workerQueue addOperationWithBlock:^{


}];
```

Controller

```
NSOperationQueue *mainQueue = [NSOperationQueue mainQueue];
RCReceptionist *receptionist =
    [RCReceptionist receptionistForKeyPath:@"value"
                                    object:model
                                     queue:mainQueue
                                      task:
     ^(NSString *keyPath, id object, NSDictionary *change) {
          // This will execute on the main queue
     }];


[workerQueue addOperationWithBlock:^{
    // This will execute on a background thread

}];
```

Controller

```
NSOperationQueue *mainQueue = [NSOperationQueue mainQueue];
RCReceptionist *receptionist =
    [RCReceptionist receptionistForKeyPath:@"value"
                                    object:model
                                     queue:mainQueue
                                      task:
     ^(NSString *keyPath, id object, NSDictionary *change) {
          // This will execute on the main queue
     }];

[receptionist retain];
[workerQueue addOperationWithBlock:^{
    // This will execute on a background thread
    [receptionist release];
}];
```



Demo

Key-value observing receptionist

Summary

- Moves notification to different queue, perhaps main queue
- Allows creator to define task
- Can be expanded to filter, redirect, or more
- Download “Receptionist” example

Tips and Tricks Recap

- Zombies
  - Detect memory management errors early
- Debugging
  - Find the root cause of an issue quickly
- Overlay views
  - Easily add overlapping view drawing
- KVO receptionist
  - Update model on background thread, but update UI on main thread

More Information

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Documentation
Zombies
http://developer.apple.com/qa/qa2004/qa1367.html

gdb
http://developer.apple.com/documentation/DeveloperTools/gdb/gdb/gdb_toc.html

Creating Custom Instruments with DTrace
http://developer.apple.com/documentation/DeveloperTools/Conceptual/InstrumentsUserGuide/CreatingaCustomInstrument/CreatingaCustomInstrument.html

More Information

More Documentation

Key-Value Observing
http://developer.apple.com/documentation/Cocoa/Conceptual/KeyValueObserving/KeyValueObserving.html

Concurrency Programming Guide
http://developer.apple.com/documentation/

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